ORIGINAL RESEARCH

Care Is the Doctor's Best Prescription: The Impact of Doctor-Patient Empathy on the Physical and Mental Health of Asthmatic Patients in China

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Background: To explore the impact of empathy between Chinese doctors and patients on anxiety, self-efficacy, sleep and IL-6 levels in hospitalized asthmatic patients.
Methods: This study included 195 asthmatic patients and 30 respirologists in China. The Jefferson Empathy Scale (JSE) was used to measure the empathy level of doctors, and the consultation and relational empathy (CARE) scale was used to measure patients' perception of empathy between themselves and their doctors. Doctors were divided into three groups, according to JSE scores. Data about anxiety, self-efficacy, sleep and IL-6 were collected and compared between patients in different JSE groups at admission (T1) and 3 months later (T2). The correlation between JSE scores and CARE scores was analyzed. Pearson correlation analysis along with a structural equation model was applied to explore the relevance among anxiety, self-efficacy, sleep, inflammatory factors (IL-6) and patients' perception of empathy shown by their doctors.
Results: There was no statistical difference between the indices of patients in three groups at admission. For all patients, the changes of indicators were statistically different from T1 to T2. Three months later, patients in high empathy scoring group showed lower anxiety and IL-6, and higher self-efficacy and sleep quality. There was a positive correlation between JSE and CARE scores. Patients' perception of doctor-patient empathy was negatively correlated to anxiety levels and IL-6, and positively correlated to self-efficacy and sleep quality. Anxiety, self-efficacy and sleep quality were mediators in the relationship between patients' perception of empathy and IL-6.
Conclusion: In the Chinese sample, anxiety, self-efficacy, sleep, empathy between doctors and patients and IL-6 are closely correlated. Anxiety, self-efficacy and sleep may play additional roles in the influence of patients' perception of empathy between doctors and patients on IL-6 in asthmatic patients.
Keywords: doctor-patient relationship, empathy, asthmatic, self-efficacy, anxiety, sleep, IL-6, China

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Introduction

Bronchial asthma is a common psychosomatic disease of the respiratory system. Many mental stressors, such as anxiety, disappointment, distress, anger, fear and depression can cause asthma.[1] At the same time, the quality of life of patients with asthma is reduced, and other psychological problems including depression, anxiety, mania, panic disorder, sleep disorder, and post-traumatic stress disorder can appear.[2] Therefore, it is extremely important to support the psychological health of patients with asthma. In addition, because asthma is characterized by chronic airway inflammation, inflammatory factors

are one of the important monitoring indicators of patients, which require attention from doctors.[3]

The doctor-patient relationship is important both medically and socially. At present, disputes between doctors and patients often occur in the mainland of China, and medical staff have been wounded or even killed in recent years.[4] Unfortunately, Chinese doctors are facing more work pressures and have less time to communicate with patients.[5] Additionally, they subjectively pay more attention to identifying the disease rather than listening to the patient, are unwilling to communicate or sympathize with the patient, and lack appropriate training.[6] However, hospitalized patients are heavily dependent on their doctors for care and advice. A good doctor–patient relationship and communication are not only helpful in improving patient satisfaction, but also beneficial to patients' mental health and hospital experience.[7,8] Compared to skilled communication, empathy refers to the ability of one person to understand others' unique experience, respond appropriately to it and demonstrate altruistic behavior.[9]

Doctor-patient empathy refers to the establishment and deep understanding of the emotional relationship between doctors and patients. The important role of doctor-patient empathy in patients' physical, psychological health and social adaptation has been confirmed by many studies.[10,11] Since asthma patients have a long course of illness and recurrent attacks, they require an understanding of their illness, as well as attention and support from caregivers. Therefore, this study focuses on the relationship between physical and mental health of hospitalized asthma patients and physician-patient empathy in the context of Chinese culture, and explores its possible effects.

Anxiety is an important psychological indicator that has been studied by many researchers in asthma patients. It is closely related to the patient's quality of life, control of disease, and other outcomes.[12–14] Self-efficacy refers to the degree of self-confidence of an individual in a specific situation. According to the theory, people who have high self-efficacy are motivated, demonstrate effort and persistence in their daily activities, and their health results are often good.[15] As a result, self-efficacy is often used as one of the important indicators in the study of patients with chronic diseases.[16] IL-6 is a cytokine which can stimulate cell proliferation, differentiation and improve the immune response. It also plays an important role in the health assessment of patients with inflammatory diseases.[17] The correlation between IL-6 and mood has been confirmed.[18] Therefore, in this study, we measured patients' outcome including an assessment of anxiety, self-efficacy,

sleep and IL-6, which are all closely related to the mental state of the patient.[19] In this study, two hypotheses were proposed: 1) patient perception of doctor-patient relational empathy directly affects IL-6 production; 2) patient perception of doctor-patient relational empathy indirectly affects IL-6 with anxiety, self-efficacy and sleep having mediating roles.

Materials and Methods

Participants

From the total pool of asthmatic patients, we selected patients using a random number table method, who were offered study participation. The study included 195 patients with bronchial asthma who were hospitalized in 6 centers from January to August 2019. Selection criteria were as follows: 1) asthma was diagnosed and patient was hospitalized for at least 7 days, and 2) patients understood their diagnosis and provided informed consent to participation in the study. Patients with acute infectious disease, cancer, psychiatric disease, Parkinson's disease and others which may have significant effects on sleep, mental state and/or IL-6 were excluded from the study. In this study, 30 respiratory specialists treated patients and provided health guidance to them.

Procedures

The main steps of the study are outlined in this section. First, the doctor's ability to empathize was assessed with the Jefferson Empathy Scale (JSE) prior to the inclusion of the first patient in the study, and they were divided into three groups according to the average JSE scores with 10 doctors in each group. Second, on the day of admission (T1) and 3 months later (T2), anonymous cross-sectional questionnaires were conducted, including a scale to assess anxiety and self-efficacy. Data relating to sleep patterns and serum IL-6 were collected at the same time (T1 and T2). Data on patients' perception of doctor-patient relational empathy were collected at T2. For all patients, their indexes at T1 and T2 were compared. The correlation between doctors' empathy score and patient perception of doctor-patient relational empathy was analyzed. As a final point, the relationships between anxiety, self-efficacy, sleep, IL-6 and patients' perception of doctor-patient relational empathy were explored.

Measures
Demographic and Disease Information

The gender and age of the patients and doctors were collected. The average number of days in hospital for each patient was recorded.

Assessment of Doctor's Empathy

The Jefferson Empathy Scale (JSE), Chinese version, was applied to measure the empathy level of doctors. The scale was first developed at Jefferson Medical College in 2001 to measure the empathy level of medical staff in clinical work, and consists of three dimensions: compassionate care, perspective taking, and standing in the patient's shoes.[20] The assessment included 20 questions; each response was scored on a scale of 1–7. A score of 1 indicates "strong disagreement" and a score of 7 indicates "strong agreement". Therefore, the JSE score ranges from 20 to 140, and the higher the score, the stronger the ability to empathize.[21] The Cronbach's alpha of JSE was 0.895 in this study.

Patient Perception of Doctor-Patient Relational Empathy

The patient's perception of doctor-patient relational empathy was measured using the consultation and relational empathy (CARE) scale. There were 10 items in the questionnaire, and each item was assigned 1–5 points with the total score of the scale ranging from 10 to 50. The higher the score, the more the patients perceive doctor-patient empathy.[22] The Cronbach's alpha of CARE was 0.872 in the present study.

Assessment of Anxiety

We choose the Hospital Anxiety and Depression Scale (HADS) to measure the anxiety level of patients. The scale is divided into two parts, with 7 items measuring anxiety (HADS-a) and 7 items measuring depression (HADS-d). Each response is scored from 0 to 3, and each subscale scores from 0 to 21. Higher scores indicate that patients are more anxious or more depressed.[23] For each subscale, scoring 8 or more indicates that the patient has anxiety or depression.[24] Patients complete the scale according to their actual feeling in 1 month. In this study, anxiety was measured by HADS-a, and the Cronbach's alpha was 0.902.

Assessment of Self-Efficacy

Patients' self-efficacy was measured using the General Self-Efficacy Scale (GSES) which was developed by Ralf Schwarzer.[25] The scale is widely used in China, and the reliability and validity are good.[26] The scale consists of 10 items with each item scoring from 1 to 4, and the aggregate score ranges from 10 to 40. The standard score gets from the aggregate score divided by 10. Higher scores show that patients have more self-efficacy.[25] The Cronbach's alpha was 0.897.

Sleep Efficiency

Sleep efficiency (SE), defined as the ratio of total sleep time to bedtime, was used to measure sleep quality, and polysomnography was used to measure sleep efficiency. Patients arrived at the sleep monitoring room at 20:00 and began sleeping at their normal bedtime. All patients were tested with PSG and were asked to stay in bed for 8 hrs to make sure that the time in bed was controlled. In accordance with international standardized methods, we applied surface disc electrodes to record the electroencephalogram (EEG) signals of 6 areas synchronously (F3-A2, F4-A1, C3-A2, 01-A2, 02-A1). In order to record the electromyogram (EMG) of the chin, we applied 2 surface electrodes, and placed an electrode at 1 cm above and below the lateral canthus so that the eye movements of the two eyes could be recorded.

Measurement of IL-6

Patients were asked to fast for at least 10 hrs before blood was taken. In the morning, 3 mL of venous blood was collected with vacuum sampling without using anticoagulants. The blood samples were stored for 15 mins at room temperature and centrifuged in a high-speed desktop centrifuge for 20 mins at 2000–3000 r/s. We collected and stored the upper 0.5 mL layer of serum in an Eppendorf tube. Using an ELISA kit (Beijing Hotgen Biotech Co., Ltd), the concentration of IL-6 in serum was tested with the TAn SM802 enzyme-labeling instrument (Shanghai Yongchuang Medical Devices Co.).

Statistical Analysis

EPI 3.1 software was used to enter the data and the SAS 9.4 statistical software package was used for data analysis. The data are represented as mean ± standard error of the mean (SEM). Variance analysis was used to compare the indicators of the three groups, and the paired t-test was used to compare the indexes on admission and after 3 months. A Pearson correlation analysis was applied to test the correlation between the doctors' empathy and patient perception of doctor-patient relational empathy. A Pearson correlation analysis and structural equation modeling were used to explore the correlations between anxiety, self-efficacy, sleep, serum IL-6, and patient perception of doctor-patient relational empathy.

Results

Sample

In this study, all 30 doctors agreed to participate. Twelve of them were male and 18 were female, with an average age was 41.26±5.78 years. The average empathy score of the high scoring group, moderate scoring group, low scoring group was 71.42±5.61, 90.27±4.83, and 113.62±5.36, respectively. There were significant differences in the scores of empathy between the three groups (F=165.50, P<0.0001). Two hundred and twenty (220) patients were invited to participate in the study, 195 patients enrolled, with a participation rate of 88.64%. The average age of the patients was 61.28±7.64 years, with an average hospitalization length of 7.56±0.88 days, and 102 male and 93 female participants.

Comparison of Patients' Indexes Among Different Doctor Groups (Grouping by JSE Score) at Admission (T1) and 3 Months Later (T2)

At admission, there was no significant difference in index scoring between the three groups. Three months later, the indicators of the three groups were significantly different (P<0.0001). Patients in high empathy scoring doctor group reported significantly lower anxiety, lower serum IL-6, higher self-efficacy, and sleep quality than patients in the low empathy scoring doctor group. The indexes of patients by different levels of doctors' empathy at the two time points are shown in Table 1.

Comparison of Patients' Indexes at Admission (T1) and 3 Months Later (T2)

Patients' indexes at admission and 3 months later were compared and the results are presented in Table 2.

Table 2 Comparison of Patients' Indexes at Admission (T1) and Three Months After Admission (T2)

Indexes	T1	T2	t	P
Anxiety	15.90±4.12	13.57±4.74	5.181	<0.0001
Self-efficacy	1.70±0.78	2.20±0.80	6.249	<0.0001
Sleep	65.37±10.32	69.53±10.64	3.919	<0.0001
IL-6	187.48±43.23	166.80±41.43	4.823	<0.0001

Changes in all the indexes showed significant differences between the 2 time points, the showed significant differences.

Correlation Between JSE and CARE

After analyzing the correlation between doctors' empathy (JSE score) and patient perception of doctor-patient relational empathy (CARE score), we found there was a positive correlation between them (r=0.513, P<0.01).

Correlations Between Patients' Perceptions of Doctor-Patient Relational Empathy (CARE) and Patients' Anxiety, Self-Efficacy, Sleep and IL-6 at T2

A Pearson's correlation test was used to measure the relationships between patients' anxiety, self-efficacy, sleep, serum IL-6, and patients' perception of doctor-patient relational empathy. The results showed that patients' perceptions of doctor-patient relational empathy were negatively correlated with anxiety (r=−0.479, P<0.01) and serum IL-6 (r=−0.414, P<0.01), and were positively correlated with self-efficacy (r=0.497, P<0.01) and sleep (r=0.433, P<0.01), and these results were statistically significant. The results are shown in Table 3.

Table 1 Comparisons of Indexes of Patients in Three Groups of Doctors (Grouping by JSE Score) at Admission (T1) and Three Months After Admission (T2)

Indexes	Low (n=63)	Moderate (n=66)	High (n=66)	F	P
T1: anxiety	16.27±5.86	15.78±4.65	15.68±4.32	0.258	0.773
T1: self-efficacy	1.66±0.69	1.71±0.72	1.73±0.84	0.147	0.864
T1: sleep	64.28±9.92	65.68±10.31	66.11±10.32	0.565	0.569
T1: IL-6	187.34±38.24	188.42±36.79	186.66±35.24	0.413	0.662
T2: anxiety	16.25±4.06	13.41±4.85	11.18±3.87	22.640	<0.0001
T2: self-efficacy	1.71±0.63	2.17±0.62	2.70±0.80	33.360	<0.0001
T2: sleep	64.44±9.25	67.82±9.39	76.09±9.83	25.860	<0.0001
T2: IL-6	189.05±36.35	167.80±42.18	144.56±33.11	286.00	<0.0001

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Table 3 The Relationship Between Patients' Perceptions of Doctor–Patient Relational Empathy and Self-Efficacy, Anxiety, Sleep and IL-6 in Patients

	M	SD	Empathy	Self-Efficacy	Anxiety	Sleep	IL-6
Empathy	37.110	4.797	I				
Self-efficacy	2.200	0.797	0.497**	I			
Anxiety	13.570	4.742	−0.479**	−0.385**	I		
Sleep	69.530	10.642	0.433**	0.355**	−0.592**	I	
IL-6	166.800	41.414	−0.414**	−0.426**	0.680**	−0.747**	I

Notes: **P<0.01. All the data were measured at T2. Empathy indicates patients' perceptions of doctor–patient relational empathy.
Abbreviations: M, mean; SD, standard deviation.

The Possible Mechanism of Impact of Patients' Perceptions of Doctor-Patient Relational Empathy (CARE) on IL-6 at T2: Effects on Self-Efficacy, Anxiety and Sleep

To further explore the connections among the variables, we used the path analysis method to build multiple intermediary models and used AMOS software to confirm the models described in our hypotheses. The structural equation model among the variables fitted well (GFI =0.996, CFI =0.998, NFI=0.995, AGFI=0.942, RMSEA=0.068, χ2/df =1.905), with results shown in Figure 1.

The normalized path coefficient is presented in Table 4. Patients' perceptions of doctor-patient relational empathy

(CARE) were negatively correlated with anxiety (β=−0.479, P < 0.05), and positively correlated with self-efficacy (β= 0.406, P < 0.05). Anxiety was negatively correlated with self-efficacy (β=−0.191, P < 0.05) and sleep (β=−0.499, P < 0.05). Patients' perceptions of doctor-patient relational empathy had a positive association with sleep (β = 0.195, P < 0.05). Self-efficacy (β=−0.131, P < 0.05) and sleep (β=−0.516, P < 0.05) were negatively associated with serum IL-6, anxiety was positively associated with serum IL-6 (β= 0.346, P < 0.05). All the effects listed above were statistically significant. Patients' perceptions of doctor-patient relational empathy showed no significant association with serum IL-6 (β= 0.038, P > 0.05). The above results indicate that hypothesis should be rejected.
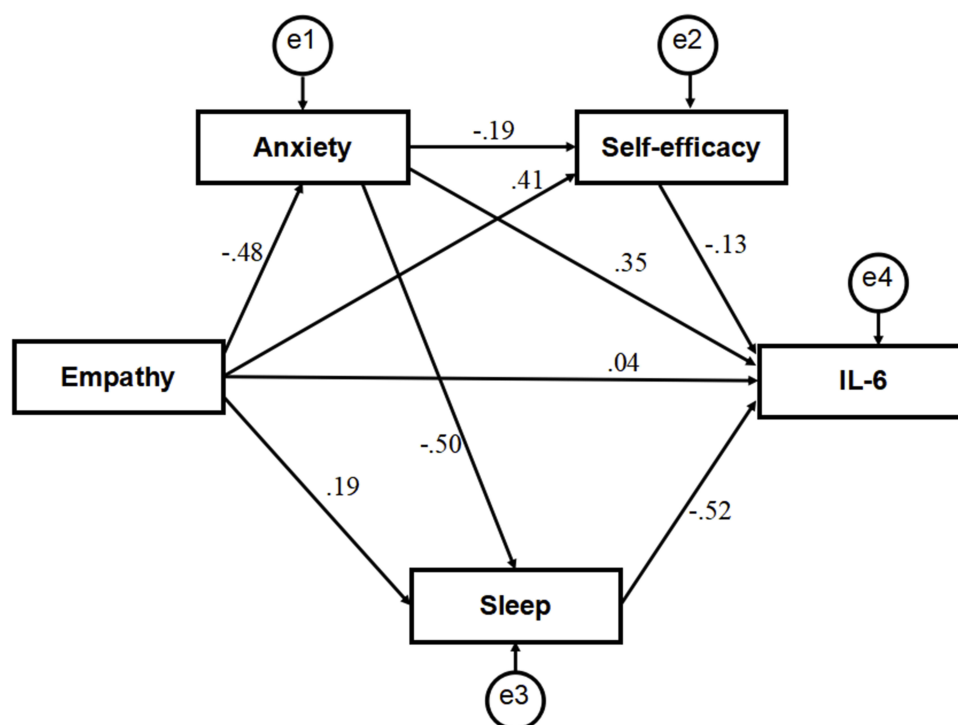

Figure 1 The model of relevance among patients' perceptions of doctor-patient relational empathy and patients' self-efficacy, anxiety, sleep quality and IL-6, with standardized beta weights.

Table 4 Standardized Path Coefficients

			Standardization Coefficient	Non-Standardization Coefficient	S.E.	C.R.	P
Anxiety	<—	Empathy	−0.479	−0.473	0.062	−7.592	***
Self-efficacy	<—	Empathy	0.406	0.067	0.012	5.826	***
Self-efficacy	<—	Anxiety	−0.191	−0.032	0.012	−2.746	0.006
Sleep	<—	Anxiety	−0.499	−1.12	0.145	−7.749	***
Sleep	<—	Empathy	0.195	0.432	0.143	3.021	0.003
IL-6	<—	Self-efficacy	−0.131	−6.761	2.566	−2.635	0.008
IL-6	<—	Anxiety	0.346	3.006	0.485	6.192	***
IL-6	<—	Sleep	−0.516	−1.999	0.208	−9.623	***
IL-6	<—	Empathy	0.038	0.33	0.457	0.722	0.47

Notes: ***$P<0.001$. All the data were measured at T2. Empathy indicates patients' perceptions of doctor–patient relational empathy.

AMOS 21.0 was used to analyze the effect of mediation between variables. We set serum IL-6 as a dependent variable, self-efficacy, anxiety and sleep as intermediate variables, and patients' perceptions of doctor-patient relational empathy as an independent variable for this analysis. The Bootstrap number was set to 5000, and the nonparametric percentile bootstrap method with deviation correction was chosen to test the degree of interaction between the variables. The results confirmed that when 0 was not contained in the confidence interval, the mediating effect was significant. In this study, five mediating paths existed between variables. Anxiety, sleep and self-efficacy worked had mediating roles between patients' perceptions of doctor-patient relational empathy and serum IL-6, with effect sizes of −0.166 (95% CI: −2.091, −0.840), −0.101 (95% CI: −1.504, −0.326), and −0.053 (95% CI: −0.904, −0.109), respectively. In the path of patients' perceptions of doctor-patient relational empathy-anxiety-self-efficacy-IL-6, when 0 was not contained in the confidence interval, the confidence interval of the effect was −0.012 (95% CI: −0.259, −0.020). According to the results, anxiety and self-efficacy played significant mediating roles between patients' perceptions of doctor-patient relational empathy and serum IL-6. In the path of patients' perceptions

of doctor-patient relational empathy-anxiety-sleep-IL-6, when 0 was not contained in the confidence interval, the confidence interval of the effect was −0.123 (95% CI: −1.548, −0.699). Thus, anxiety and sleep played significant mediating roles between patients' perceptions of doctor-patient relational empathy and serum IL-6; results are shown in Table 5.

Discussion
Doctor Ability to Empathize and Patient Outcome

Doctor-patient empathy is the emotional interaction between doctors and patients, and the establishment of emotional community. This study analyzed the empathy between physicians and patients from two viewpoints: doctors' ability to empathize, and patients' perception of doctor's empathy.

In terms of physicians' empathy ability, our research confirmed that patients who were treated by doctors with high empathy presented better psychological well-being and lower serum IL-6 levels than patients treated by doctors with low empathy ability. This demonstrates that doctors who can strongly empathize with their patients

Table 5 Mediation Effect Analysis

Route	Standardization Coefficient	Non-Standardization Coefficient	Standard Error	95% CI		P
				Lower	Upper	
Empathy→anxiety→IL-6	−0.166	−1.422	0.318	−2.091	−0.840	0.000
Empathy→sleep→IL-6	−0.101	−0.863	0.298	−1.504	−0.326	0.003
Empathy→self-efficacy→IL-6	−0.053	−0.456	0.200	−0.904	−0.109	0.010
Empathy→anxiety→self-efficacy→IL-6	−0.012	−0.103	0.058	−0.259	−0.020	0.010
Empathy→anxiety→sleep→IL-6	−0.123	−1.059	0.215	−1.548	−0.699	0.000

Notes: All the data were measured at T2. Empathy indicates patients' perceptions of doctor–patient relational empathy.

are beneficial to those patients, as previous studies have also demonstrated. For example, patients whose doctors had high empathy ability showed improved results in glycosylated hemoglobin and low-density lipoprotein tests;[27] and lower stigma, higher self-efficacy and level of NK cells.[28]

Previous studies have suggested that empathy is innate, but it can also be improved through training,[29,30] and providing training to strengthen this ability in the medical staff is necessary. Empathy is a relatively stable ability, and doctors with this ability can show empathy with different patients.

Patient Perception of Doctor Empathy and Patients' Outcome and Mechanisms

In this study, the positive impact of patients' perception of doctor empathy on their physical and psychological indicators was demonstrated. In addition, patients' perception of doctor empathy indirectly affects physiological indicators by influencing patients' psychology, giving strength to our second hypothesis. The possible mechanisms are as follows:

First, patients' perception of doctor empathy affects their anxiety, self-efficacy and sleep. The influence of empathy on patients' psychology has been confirmed by previous studies. For example, patient-perceived nurses' empathy had been confirmed to reduce the patients' distress.[31] This is especially likely for patients with cancer and chronic disease, as physician-patient empathy helps psychological adjustment.[32]

We believe that the reasons are as follows. First, by showing empathy, patients receive patient-centered care, and feel more love, support, concern and respect.[33] Doctors also encourage patients to share their experiences and ideas, which helps to increase their self-efficacy and self-management ability when facing the disease, enhances their ability to cope with life and disease, and enhances their confidence in restoring health.[34] Furthermore, empathy promotes the benefit of shared decision-making between doctors and patients, which increases patient autonomy, and helps them participate in the treatment and management of their own disease.[35]

Additionally, patients receive more personalized and in-depth health education after sharing their needs and opinions and being understood by the doctors, which helps to increase their compliance and reduce the uncertainty of disease. As a result, treatment effect and patients' mood are better.[36,37] Further, with empathetic treatment,

patients' can release negative emotions, and medical staff can respond to their story appropriately and give positive psychological guidance, which is of great benefit to patients' mental health. Moreover, after empathizing with patients and sharing their stories, doctors may provide more humanistic care in the process of treatment, so patients' mental state will be improved. Finally, the mental health of patients is improved, which affects serum IL-6. Similar to the results of this study, the effects of empathy on physiological indicators such as inflammatory markers have been confirmed in previous studies. For example, Rakel et al found that in patients with colds, neutrophil counts and IL-8 levels were lower in patients who perceived more empathy from doctors.[38]

The mechanism of the effect of mental health on proinflammatory factors has been investigated previously, and negative psychology, such as stress, can stimulate immune activation, leading to changes in cytokines.[39] In addition, patients with positive psychology show strong adherence and disease management ability, which is conducive to the rehabilitation of the disease, so their proinflammatory factors are low.[40] Previous studies have confirmed that sleep deprivation can also enhance cortisol and serum IL-6 levels.[41]

In addition, anxiety and self-efficacy, anxiety and sleep have chain-mediated effects on the impact of empathy on serum IL-6. Since empathy affects anxiety, anxiety can directly affect self-efficacy and sleep, and self-efficacy and sleep also affect serum IL-6. Anxiety affects self-efficacy because it acts as a negative psychological barrier to subjective initiative and positive behavior.[42] Anxiety can directly affect sleep because anxiety affects people's psychological state before falling asleep and delays the time to fall asleep.[43] Long-term anxiety helps improve the arousal level of the brain when sleeping,[44] increases cortisol, makes rhythm changes, and affects melatonin, which are closely related to sleep.[45,46] Therefore, the emotional management of asthma patients should be included as a part of disease management.

Narrative Medicine: The Way to Realize Doctor-Patient Empathy

Narrative medicine and empathy are inseparable, and doctor-patient empathy is easy to achieve in the narrative process. The concept of narrative medicine was first proposed by Rita Charon at Columbia University in 2001. She described narrative ability as the ability to absorb, explain and respond to stories and other human predicaments.[47]

Narrative medicine enriches the medical staff's understanding of life, suffering and death through patients' stories, and encourages humanistic medical care in narration and empathy.[48] Narrative medicine requires medical staff to listen carefully to patients' stories and give them positive responses and appropriate guidance, which helps establish the emotional community between doctors and patients. As well, narrative medicine is the extension of narrative therapy, and narrative and empathy are part of a psychological intervention to some extent.[49]

At present, in medical education and clinical practice, the role of narrative medicine in enhancing the empathetic ability of medical staff and helping promote patients' outcome has been well-established.[50,51] Doctors should pay attention to practicing the concept of narrative medicine, and encourage patients to tell stories about their diseases, demonstrate empathy to patients in stories, and integrate narrative medicine into patient education. Narrative medicine education and empathy training should be included in medical education, especially in developing countries where medical humanities education is lacking, as to improve the physical and mental health of patients.

Limitations

This study has some limitations, including a small sample size, highlighting the need for further cohort and large sample size studies. Additionally, there are many factors that can affect serum IL-6, such as the severity of patient disease and heterogeneity of patients.

Conclusion

This study showed doctor-patient empathy, anxiety, self-efficacy and sleep may be factors that influence serum IL-6 in patients. Self-efficacy and sleep may play mediating roles in the effect of patients' perception of doctor-patient relational empathy on serum IL-6. Therefore, clinical staff should pay attention to empathizing with patients in order to improve their physical and mental health.

Ethical Approval

The study procedures were in accordance with ethical standards. The sleep monitoring room was in the hospital and there were medical staff who could protect their health and safety. There was no risk from participating in the program, and the responses were treated confidentially. All participating patients were informed of the research process and provided written informed consent in accordance with the Declaration of Helsinki. The Wuhan University School of Medicine Ethics Committee approved the study (20160928).

Disclosure

The authors declare that they have no competing interests in this work.

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